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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/414,526	10/08/1999	YEONG-KWAN KIM	SEC.637	3413

7590 11/08/2002  
JONES VOLENTINE LLP  
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EXAMINER

CLEVELAND, MICHAEL B

ART UNIT	PAPER NUMBER
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1762

26

DATE MAILED: 11/08/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/414,526

Applicant(s)

KIM ET AL.

Examiner

Michael Cleveland

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 30 September 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 15-27 is/are pending in the application.
- 4a) Of the above claim(s) 20 and 26 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 15-19, 21-25, and 27 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.  
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).  
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_ 6) ☐ Other: \_\_\_\_\_

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## DETAILED ACTION

### *Continued Examination Under 37 CFR 1.114*

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 8/26/2002 has been entered.

### *Election/Restriction*

2. Claims 20 and 26 are withdrawn from consideration as being directed to a non-elected invention. See 37 CFR 1.142(b) and MPEP § 821.03.

### *Claim Rejections - 35 USC § 103*

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 15-18, 21-25, and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kim et al. (Appl. Phys. Lett., 71, pp. 3604-3606, hereafter Kim) in view of Marcus et al. (U.S. Patent 5,169,579, hereafter '579) and Luryi (U.S. Patent 4,806,996, hereafter '996).

Claims 15, 17-18, 25, and 27: Kim teaches loading a silicon substrate into a reaction chamber,

cleaning to uniformly terminate the surface with atomic hydrogen,  
dosing with TMA, which inherently chemisorbs to the surface,  
purging with TMA, which inherently removes any physisorbed TMA,  
and injecting water to react with the TMA to form an alumina film (p. 3604).

Kim does not teach uniformly terminating the surface bonds with oxygen atoms.

'579 teaches that a surface may be prepared for subsequent film growth (See col. 3, lines 39-68) by modifying the surface to terminate in bonds to either hydrogen or oxygen (col. 7, lines

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23-39). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have initially uniformly terminated the surface of the silicon substrate of Kim with oxygen instead of hydrogen with the expectation of similar results. '579 teaches that the oxygen-terminated surface may be achieved by exposure to oxygen, but does not explicitly state that the surface is flushed with oxygen. However, '996 teaches that a silicon surface may be oxidized (i.e., terminated with oxygen atoms) by treating with dry oxygen at 300 °C (col. 3, lines 62-65). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have providing the oxygen to terminate the surface by flushing with oxygen as described in '996 with a reasonable expectation of success. Such oxygen must inherently be part of the ALE-formed film.

Claim 16: The purging steps inherently remove physisorbed material. (Applicant recognizes that the feature achieved by purging, for instance, at p. 11, lines 6-11).

Claim 21: Kim teaches that the substrate may be cleaned of a native oxide before being loaded into the chamber, but does not explicitly state that the cleaning step comes before loading the substrate into the chamber. However, it appears that it would have been obvious to one of ordinary skill in the art at the time the invention was made to have provided the cleaning step before loading the substrate into the ALD chamber in order to avoid damage to and contaminants in the ALD chamber by the HF used in the cleaning process.

Claim 22-23: A final purge inherently removes the by-products and any intermediates of the reaction (p. 3604, col. 2). Methane (CH<sub>4</sub>) is a by-product of the reaction (p. 3604, col. 1).

Claim 24: The step of introducing oxygen must occur for finite period of time, and therefore that period can be subdivided into the first half of the time, during which oxygen is introduced the first time, and the second half of the time, during which oxygen is introduced a second time.

5. Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kim in view of '579 and '996 as applied to claim 15 above, and further in view of Comizzoli et al. (U.S. Patent 5,851,849).

Kim, '579, and '996 suggest the formation of an alumina film by ALE, but do not explicitly teach the formation of other oxide films.

'849 teaches that other oxide films than alumina, such as TiO<sub>2</sub>, may be formed by ALE using other metal precursors (col. 7, lines 1-42).

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Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used the method of Kim, '579, and '751 to have formed a film of a different metal oxide, such as titania with a reasonable expectation of success because '849 teaches that the process can be adapted to other metal oxides, and indicates that those metal oxides are of interest as passivating films.

### ***Response to Arguments***

6. Applicant's arguments filed 8/26/2002 have been fully considered but they are not persuasive.

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Applicant argues that they have not attacked references individually where the rejection is based on a combination of references. The argument is incorrect: Applicant argues that the objective of Kim is to "remove native oxides in the pretreatment [of the substrate]". The Examiner disagrees. The objective of Kim is to deposit a film by ALE on a uniformly terminated surface. Marcus teaches the equivalence of uniform oxygen termination with uniform hydrogen termination. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have terminated the surface with oxygen instead of hydrogen with the expectation of similar results. The fact that Kim terminates with hydrogen and not with oxygen does not obscure the teachings of Marcus, and therefore Applicant's arguments directed to the teachings of Kim alone do not address the combination references.

Applicant's allegations that ALD is not a conventional technology (Such is actually refuted by the prior art of record (e.g., Kim).) and that conventional techniques cannot be adapted to ALD are unsubstantiated by evidence.

Applicants arguments regarding the new limitations are unconvincing in view of newly cited Luryi.

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***Conclusion***

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael Cleveland whose telephone number is (703) 308-2331. The examiner can normally be reached on 9-5:30 M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Shrive Beck can be reached on (703) 308-2333. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 306-3186 for regular communications and (703) 306-3186 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

*MBC*

MBC

November 6, 2002



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